USE OF VISUAL AIDS IN THE MORENCI BRANCH SAFETY PROGRAM, PHELPS DODGE CORP., MORENCI, ARIZ.

By M. L. Williams and Allen D. Look

* * * * * * * * * * Information Circular 7598

UNITED STATES DEPARTMENT OF THE INTERIOR
Oscar L. Chapman, Secretary
BUREAU OF MINES
James Boyd, Director

Work on manuscript completed August 1950. The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is made: "Reprinted from Bureau of Mines Information Circular 7598."

March 1951

Generated on 2024-09-19 22:50 GMT / https://hdl.handle.net/2027/osu.32435030643704
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

USE OF VISUAL AIDS IN THE MORENCI BRANCH SAFETY PROGRAM, PHELPS DODGE CORP., MORENCI, ARIZ.

by

M. L. Williams[1/] and Allen D. Look[2/]

CONTENTS

	Page
Introduction	1
Summary	1
Acknowledgment	2
General information	2
Equipment	2
Use of equipment	3
Investigating and reporting accidents	3
Review of accidents at safety meetings	4
Job training	4
Pre-assignment training	4
Employee training	4
Other visual aids	5
Bulletin boards	5
Safety posters	5
Accident-record boards	6
Miscellaneous	6
Accident statistics	6

ILLUSTRATIONS

Fig.		Follows page
1.	Reenactment of an accident	2
2.	Safety meeting of Morenci Branch employees	4
3.	Reenactment of shop accident	4
4.	Prepared display of safety glasses that saved an eye	4
5.	Large safety poster near mine entrance	6
6.	Division accident-record board	6
7.	Department accident-record board	6

1/ Mine safety representative, Bureau of Mines, Phoenix, Ariz.
2/ Mining engineer, Bureau of Mines, Phoenix, Ariz.

Information Circular 7598

Generated on 2024-09-19 22:39 GMT / https://hdl.handle.net/2027/osu.32435030643704
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

INTRODUCTION

In recent years the use of visual aids has expanded the field of safety education. This is a modern adaptation of a method employed in ancient times, when simple paintings and drawings were the only means of recording current events. In its present application, visual aid employs sound and silent motion pictures, stripfilms, lantern slides, descriptive posters, and color.

According to Roberts,3/ "Visual education is a method of imparting information which is based on the psychological principle that one has a better conception of the thing he sees than of the thing he reads about or hears discussed." Dent4/ further defines visual aid as "all the materials used to facilitate the understanding of the written or spoken word."

That this method of instruction is highly effective was demonstrated practically during World War II, when both industry and the armed forces, faced with the tremendous task of training thousands of men and women in new manufacturing techniques and the many phases of modern warfare in the shortest possible time, resorted successfully to visual instruction aids. Visual aids are being employed increasingly in industry and in our educational systems, and numerous publications are devoted to the technique of using them.

Safety promotion will always be difficult, and those engaged in it are constantly searching for new methods. It was only natural that progressive advocates of safety should recognize the possibilities of visual aids and should incorporate such aids in their accident-prevention programs.

Although a good many industries are now using visual aids in some form for teaching operating methods and safety, only those in use at the Morenci Branch, Phelps Dodge Corp., Morenci, Ariz., will be discussed in this circular.

SUMMARY

The use of visual aids in the safety program at Morenci is reported to have caused no appreciable increase in the cost of operating the safety department.

A substantial decline in the accident-frequency rate from 8.37 in 1945 to 5.23 in 1949 is attributed largely to the increased interest in safety developed through the use of visual aids at the monthly safety meetings. In addition, the accident severity rate was reduced from 1.74 in 1945 to 0.185 in 1949.

3/ Roberts, A. B., An Introduction to Visual Aids: School Activities, vol. 10, Jan. 1939, p. 212.

4/ Dent, E. C., The Audio-Visual Handbook: The Society of Visual Education, Inc., Chicago, Ill., rev. ed., 1939, p. 1.

Generated on 2024-09-19 22:39 GMT / https://hdl.handle.net/2027/osu.32435030643704
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

ACKNOWLEDGMENT

The authors appreciate the courtesies shown by the officials and employees of the Morenci Branch, Phelps Dodge Corp., particularly Paul Simmons, safety engineer.

GENERAL INFORMATION

Prior to 1945, the use of visual aids at Morenci was limited to bulletin boards, safety posters, color coding of pipe lines, and the usual warning signs. In 1947, a standard code for dimensional-color painting of shop machinery was adopted.

Films and slides were first used in the autumn of 1945 to supplement the employee monthly safety meetings, and the increased interest of supervisors and employees stimulated development of the present program.

Visual aids to safety education are presented to the employees at every safety meeting either in the form of 16 mm. sound films, 35 mm. filmstrips, or 2- by 2-inch slides. At least half of each 30-minute meeting is devoted to these means of safety training.

Visual-aid equipment is used effectively in reporting and discussing accidents and property damage resulting therefrom. Black-and-white photographs supplement each written report of an accident or property damage. Enlarged photographs of selected accidents, together with pertinent details of the accident, are posted on safety bulletin boards. Color transparencies also are made for later use at the monthly safety meetings.

Safety bulletin boards, safety posters, and the use of color codes are an integral part of visual education in safety and are used advantageously at Morenci.

EQUIPMENT

The good results obtained from the use of visual aids at Morenci are attributed, in part, to the effective use made of the excellent equipment provided. This equipment consists of:

Still cameras

4 x 5, press-type, with 135 mm., f4.5 lens, synchronized photoflash equipment, coupled range finder, interchangeable back, and accessory lenses and filters.

28 x 44 mm. miniature, with f4.5 lens and accessory lenses and filters.

Motion picture cameras

16 mm., turret head, with f1.9 regular lens and 3x and 4x telephoto lenses and accessory filters.

16 mm., magazine load, with f1.9 lenses.

Generated on 2024-09-19 22:43 GMT / https://hdl.handle.net/2027/osu.32435030643704
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

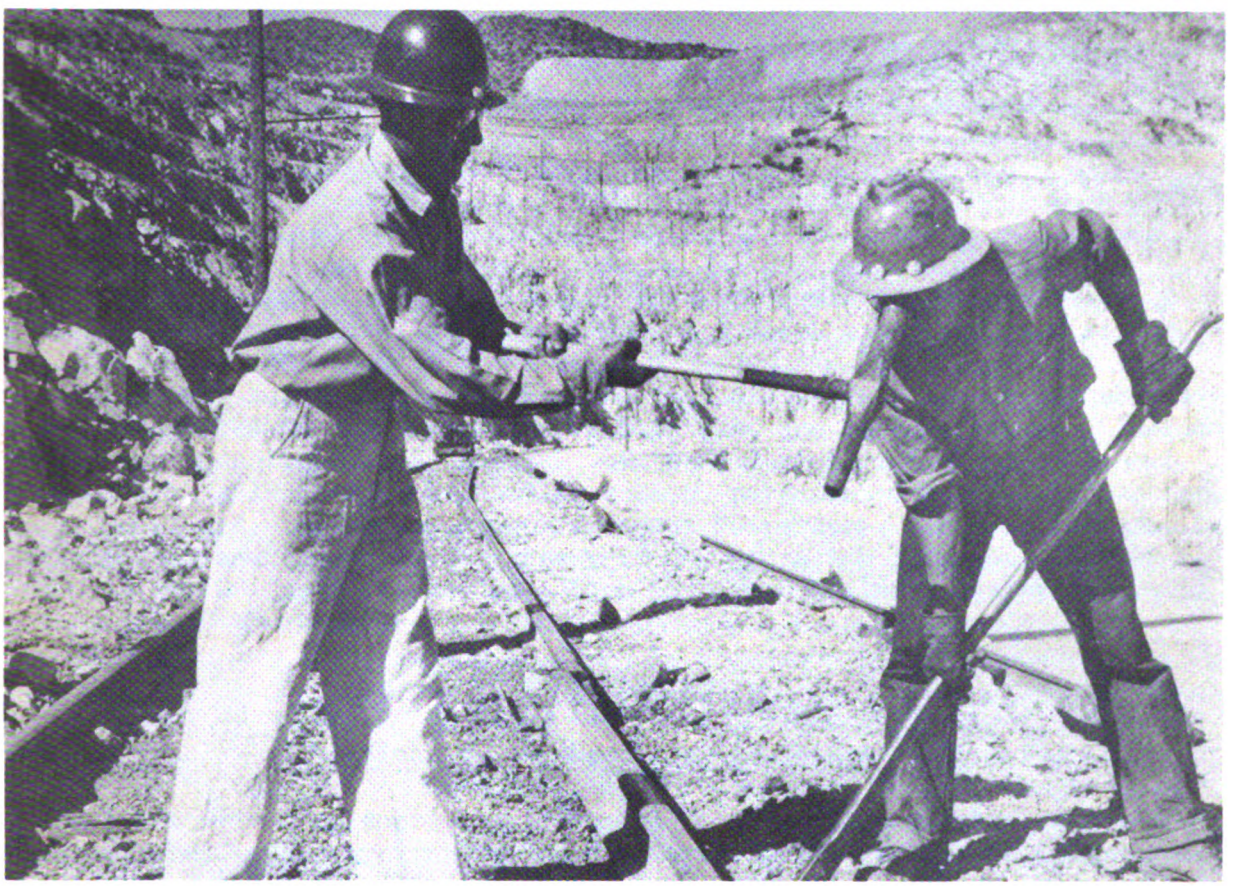

Figure 1. - Reenactment of an accident.

Generated on 2024-09-19 22:50 GMT / https://hdl.handle.net/2027/osu.32435030643704
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from
THE OHIO STATE UNIVERSITY

Miscellaneous

Dual-speed record player with amplifier for use with stripfilms.

Light meter.

Portable projection screen.

Kit, for binding 2- by 2-inch glass slides.

Microphone and stand used in conjunction with silent 16 mm. motion picture films and stripfilms.

Library of catalogs and publications pertaining to film sources.

Library of stripfilms.

File boxes for glass slides.

A 12- by 12-foot dark room is equipped for developing and printing of film. The equipment includes a 4 x 5 enlarger and a 4 x 5 contact printer.

The safety meeting rooms at the mine and at the reduction plant are especially equipped for showing films, stripfilms, and slides. A 24- x 31-foot room at the reduction plant and a 20- by 30-foot room at the mine are each equipped with a large wall projection screen, permanent stand for projectors, large blackboard, table, and seats for about 80 persons. The windows are blackened to insure maximum darkness when the projector is used. Another room - 16 by 20 feet - at the reduction plant is similarly equipped for the convenience of the smelter employees.

USE OF EQUIPMENT

Investigating and Reporting Accidents

All lost-time accidents and also most of the accidents that do not involve personal injury are investigated. Every effort is made to investigate an accident "on the ground" as soon as possible while the pertinent details are fresh and clear in the minds of witnesses. From their version of the accident, it is reenacted and photographed in black-and-white and color. Witnesses ordinarily cooperate wholeheartedly in "acting out" the accident. Figure 1 shows such a reenactment after a track-laying accident, in which a spike hammer was deflected from the rail and struck a worker in the face.

The 4 x 5 press camera is used in obtaining black-and-white photographs, which can be processed quickly. Such photographs, together with pertinent descriptive titles, are used to supplement the written report of the accident, providing a pictorial record that adds emphasis to the written word. Property damage reports, usually for insurance or litigation purposes, also are accompanied by photographs. Copies of such photographs are placed in a loose-leaf album and constitute a photograph index of all accidents.

Generated on 2024-09-19 22:41 GMT / https://hdl.handle.net/2027/osu.32435030643704
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

The miniature camera is used for making color transparencies, which are taken in duplicate. This miniature camera, using eight-exposure film rolls, was selected over other miniature-type cameras that ordinarily use 20- or 40-exposure film rolls, because of its superior speed and economy. The 20- or 40-exposure film rolls contain more exposures than are needed to obtain a photographic record of a single accident, and their use results in either a waste of film to obtain a few exposures or an indefinite delay until the remainder of the film can be exposed.

Exposed color film is mailed to the nearest processing laboratory, where it is processed and each transparency is mounted in a cardboard slide. The safety engineer examines the returned transparencies with a hand viewer and selects those appropriate for his use. The selected transparencies are then mounted in 2- by 2-inch glass slides, which, when completed, are carefully titled, classified, and indexed for use at safety meetings to supplement discussion of accidents.

Review of Accidents at Safety Meetings

The details of every lost-time accident in 1948 and the years following were recorded and photographed in black and white and in color and provide an invaluable source of reference material. If any particular type of accident should become prevalent, a series of slides on that subject is taken from the files and shown at the monthly safety meetings. Color gives a realistic quality to the depicted scenes. The effect is heightened further by the knowledge that each picture is a colorful reenactment of an accident with which the audience is familiar.

Job Training

Two job-training films have been completed: (1) "Track Work" and (2) "Laying Track Section." Both are directed primarily at new employees, who generally are assigned to work on the tracks. Each film is in black and white and is about 400 feet long. At present another film, to be entitled "Railroad Signaling," is in the project stage.

Pre-assignment Training

Before a new employee is assigned to any job, he is sent to the safety department, where he receives his primary instruction in working safely. This instruction includes visual demonstrations of the protection provided by the various articles of protective clothing he will be required to wear on the job and the proper way of lifting to avoid strain. A short lecture on general safety practices by the safety engineer is followed by an instruction stripfilm with a transcribed commentary, which emphasizes the safety engineer's previous instruction.

Employee Training

At intervals during the year, all employees receive visual instruction on pertinent safety subjects at their monthly safety meetings. These instructions are given by means of stripfilms with recorded commentaries,

Generated on 2024-09-19 22:41 GMT / https://hdl.handle.net/2027/osu.32435030643704
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

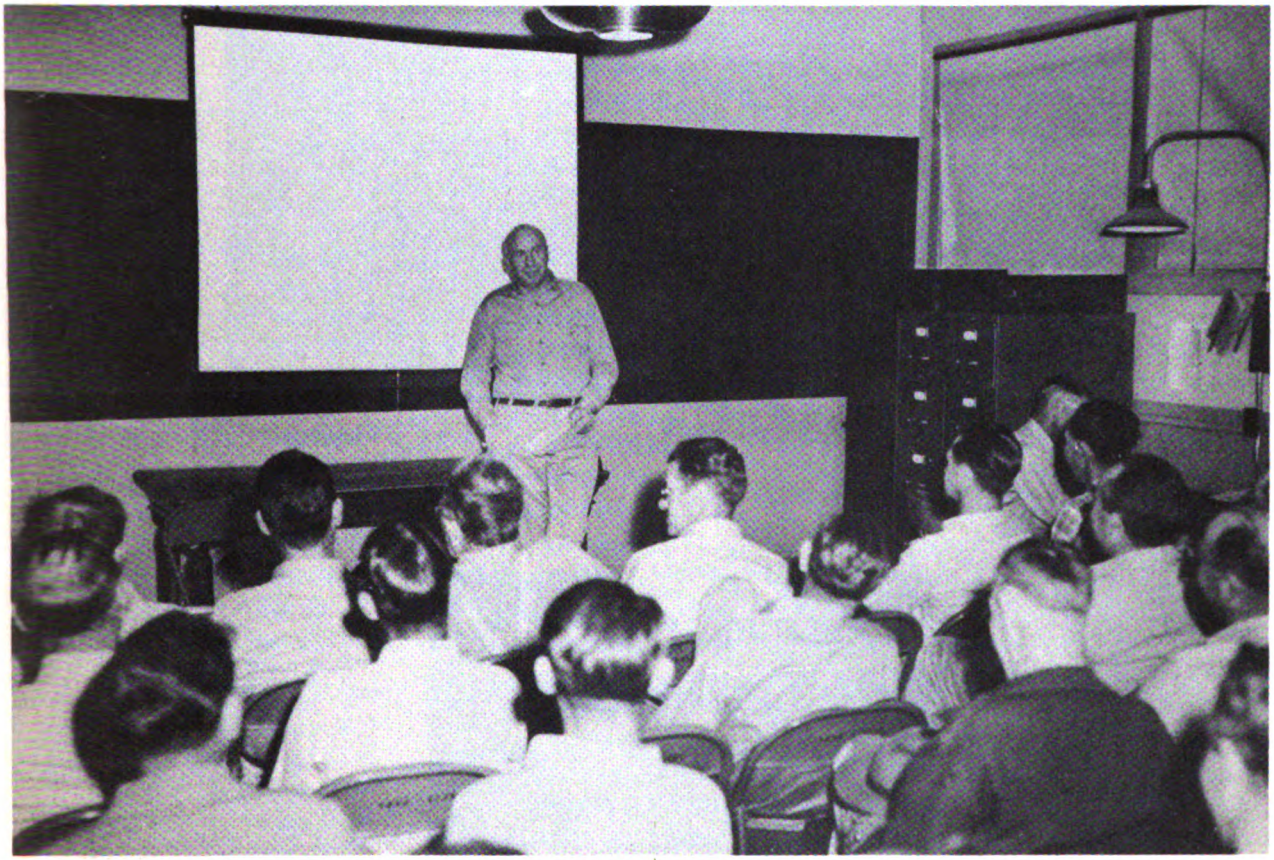

Figure 2. - Safety meeting of Morenci Branch employees.

Generated on 2024-09-19 22:46 GMT / https://hdl.handle.net/2027/osu.32435030643704
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google

Original from
THE OHIO STATE UNIVERSITY

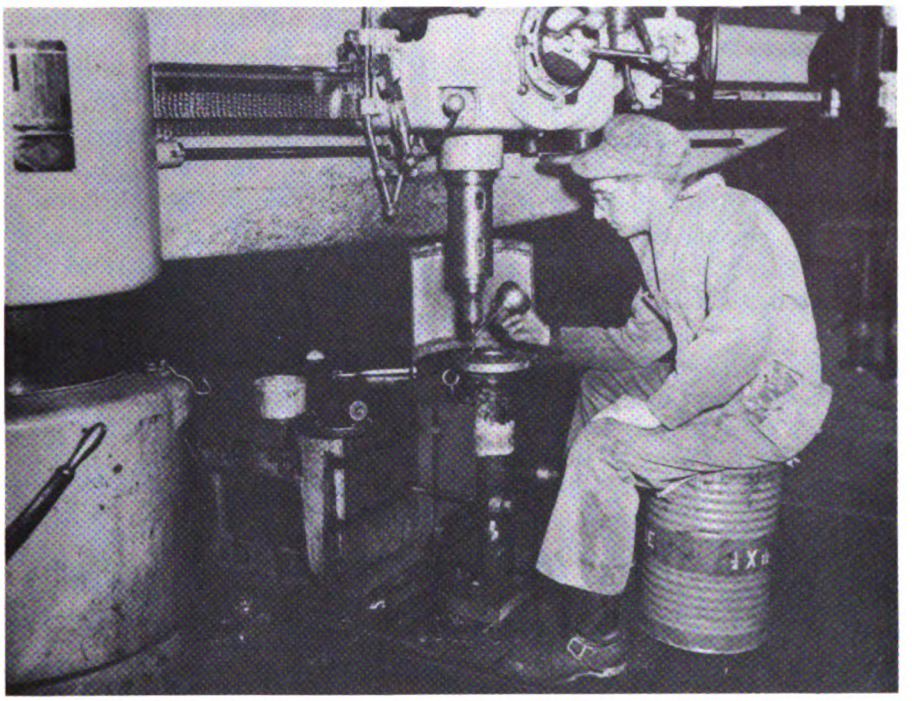

Figure 3. - Reenactment of shop accident.

Figure 4. - Prepared display of safety glasses that saved an eye.

Generated on 2024-09-19 22:45 GMT / https://hdl.handle.net/2027/osu.32435030643704
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

supplemented by 16 mm. sound films on current subjects such as safety on the highway and in the home.

Both strip and 16 mm. films are purchased, rented, or borrowed from various sources. A library of film sources is kept up to date for this purpose.

The monthly safety meetings at Morenci provide an ideal arrangement whereby all employees benefit by viewing these slides, stripfilms, and sound films. The meetings are held during the working shift, and attendance is compulsory (fig. 2). To allow every employee to attend the monthly meetings necessitates holding an average of 50 meetings every month. In 1949 610 such meetings were held, and slides, stripfilms, or 16 mm. sound films were shown at each. Each meeting lasts about 1/2 hour, of which not more than 20 minutes was devoted to films or slides and the remainder to discussion.

On-the-job safety meetings are held for employees who are unable to attend the large day meetings because of special duties or because of working on an afternoon or evening shift.

OTHER VISUAL AIDS

Before the advent of motion-picture films, stripfilms, and slides, visual safety aids were limited to bulletin boards, safety posters, and safety signs. These, however, are an integral part of visual-aid instruction in a successful safety program.

Effective use is made of safety bulletin boards, safety posters, and identification signs at Morenci. Their effectiveness is due to their simplicity and eye appeal.

Bulletin Boards

Safety bulletin boards at the reduction plant and at the mine are strategically located at each time office. These boards are used exclusively for information, notices, and posters pertaining to safety. Notices that pertain only to outside activities or to general matters not related to safety are posted on separate bulletin boards provided for such notices. After the notices or bulletins have served their purpose they are removed promptly. They are changed at least once a month and are not allowed to accumulate on the borads.

Accident photographs sometimes are displayed on the bulletin boards. One typical display to show the saving of an eye through safety glasses, when a drill-press operator was struck by a flying object, consisted of two photographs; the first (fig. 3) showed a reenactment of the position of the operator at the time of the accident, and the second (fig. 4) showed a prepared display of the broken lens and the flying object.

Safety Posters

Large safety posters 9 feet 11 inches by 11 feet 8 inches, well illuminated, are displayed prominently near the entrances to the reduction plant

Generated on 2024-09-19 22:41 GMT / https://hdl.handle.net/2027/osu.32435030643704
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

and the mine (fig. 5). These also are changed at least monthly. Small safety posters are displayed on the bulletin boards previously mentioned.

Accident-Record Boards

Accident-record boards 8 by 10 feet are installed in front of the headquarters of each division and each subordinate department. The boards are painted green, are provided with removable, white-painted, metal letters and numerals, and are repainted frequently enough to maintain an attractive appearance. The records on these boards are changed each month. The division board displays the accident record of the entire division and each subordinate department as well as a short safety message or slogan, which also is changed monthly (fig. 6). The department board displays the accident record of the various crews or shifts in that department (fig. 7).

MISCELLANEOUS

Eye-catching colors that serve as visual reminders are used effectively in the safety program at Morenci.

A standard piping color code is used. Shop machinery also is painted in dimensional colors - light green, buff, and red. Abrupt changes in floor levels, low overhead clearances, and stair risers are painted bright yellow. The locations of fire-fighting equipment are indicated with diagonal white stripes on a red background. The trailing cables that supply power to electrical equipment in the pit also are yellow in color. A service truck used in the pit by the safety department is a brilliant yellow; it is the only vehicle in the pit so colored.

The location of various departments and buildings is indicated by large signs with black, shadowed letters 6 inches high on a white background, which are easily visible 300 feet away (fig. 6).

ACCIDENT STATISTICS

The results of a continued safety program at Morenci are reflected in the following accident records:

Year	Frequency	Severity
1945	8.37	1.74
1946	11.78	.91
1947	8.00	1.138
1948	7.52	1.171
1949	5.23	.185

A Certificate of Honor was awarded to the Morenci Branch based on operation on an open-pit mine, mill, and smelter without a fatality from January 4, 1945, to January 31, 1948, and continuing, with a combined exposure of 14,924,776 man-hours. During the same period, the open pit had 5,319,637 man-hours of exposure and mined 81,400,000 tons of ore and waste.

Interior - Bureau of Mines, Pittsburgh, Pa.

Generated on 2024-09-19 22:44 GMT / https://hdl.handle.net/2027/osu.32435030643704
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Figure 5. - Large safety poster near mine entrance.

Generated on 2024-09-19 22:44 GMT / https://hdl.handle.net/2027/osu.32435030643704
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from
THE OHIO STATE UNIVERSITY

Figure 6. - Division accident-record board.

Generated on 2024-09-19 22:52 GMT / https://hdl.handle.net/2027/osu.32435030643704
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY

Figure 7. - Department accident-record board.

Generated on 2024-09-19 22:40 GMT / https://hdl.handle.net/2027/osu.32435030643704
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from THE OHIO STATE UNIVERSITY